

## REMARKS

Attorney for Applicants has carefully reviewed the outstanding Office Action on the above-identified application. Applicants have amended the application, and respectfully submit that the application, as amended herein, is in condition for allowance.

Applicants have amended each of the independent claims to further highlight the modulation scheme employed by the present invention. Claims 1 and 11 now recite the limitations of “**an amplitude modulator for amplitude modulating the electromagnetic signal to produce an amplitude modulated signal; ... a demodulator for demodulating the reflected amplitude modulated signals to produce a demodulated signal; ... and a signal processor for extracting and analyzing a vibration waveform from the demodulated signal.**” Additionally, claim 21 was amended to recite the limitations of “**...amplitude modulating the electromagnetic signal with an amplitude modulating signal to produce an amplitude modulated signal, and ... demodulating the reflected amplitude modulated signal to produce a demodulated signal....**” Further, claim 32 was amended to recite the limitations of “**...amplitude modulating an electromagnetic signal with an amplitude modulating signal to produce an amplitude modulated signal; ... and processing the reflected amplitude modulated signals to extract information about the properties of the object.**” Applicants have also amended dependent claims 6, 10, 16, 26, 31, 37, 40, and 43 for clarity, and have amended claims 27 and 38 to remove the limitation “low coherent.” No new matter is believed to have been introduced by these amendments.

Applicants respectfully traverse the rejections raised over U.S. Patent No. 4,554,836 to Rudd and the various rejections raised over Rudd in view of U.S. Patent No. 5,915,050 to Russell, et al., U.S. Patent No. 4,481,825 to Kljuev, et al., 5,897,494 to Flock, et al., and U.S. Patent No. 5,495,767 to Wang, et al., and submit that the pending claims are patentable over these references, taken alone or in any combination.

Rudd discloses a laser vibrometer. A laser beam is deflected by a Bragg cell into two beams, and the frequency of one of the beams is shifted (frequency modulated) by the Bragg cell. The shifted beam is sent to an object of interest, and the reflected signal is mixed (heterodyned) with the unshifted portion of the laser beam in a photodiode to produce a phase modulated signal the same frequency as the Bragg cell. The phase modulated signal is then demodulated to measure surface movement and velocity.

Russell, et al. discloses an optical device comprising an optical fiber directional coupler that includes a coupling region and an acousto-optic device connected to a portion of the coupling region. The acousto-optic device imparts a spatially-periodic perturbation in the coupling region. The device can be operated as a frequency shifter or optical switch.

Kljuev, et al. discloses a device for measuring vibrations, which includes a microwave generator, a waveguide system, a parabolic antenna for sending microwaves to an object of interest, and optical system for aiming the device.

Flock, et al. discloses a vibrometer for measuring vibrations of small anatomical structures, such as parts of an ear. A diode laser sends a laser beam to the anatomical structure, which produces a speckle interference pattern. The speckle interference pattern is received by the invention and processed to determine the amplitude and frequency of the vibrations generated by the anatomical structure.

Wang, et al. discloses a laser vibrometer that includes a laser beam, a beam splitter, two reflectors, an optical processor having two optical sensors, a digitizer for converting analog signal to a digital signal, a flip-flop circuit, and a counter. The device employs split laser beams to measure an object's vibrations.

Applicants respectfully submit that claims 1-2, 7, 9-10, 11-12, 17, 19-22, 27, 29-33, 38, and 41-43, which were rejected as being anticipated by Rudd or, in the alternative, obvious over Rudd in view of Russell, et al., are patentable over these references. Both Rudd and Russell, et al., taken alone or in combination, fail to teach or suggest “an **amplitude** modulator for **amplitude modulating** an electromagnetic signal to produce an amplitude modulated signal... a receiver for receiving a reflected amplitude modulated signal from the vibrating object... and a demodulator for **demodulating the reflected amplitude modulated signal...**” as set forth in independent claims 1 and 11. Additionally, both Rudd and Russell, et al., taken alone or in combination, fail to teach or suggest “**amplitude** modulating an electromagnetic signal **with an amplitude modulating signal** to produce an **amplitude modulated signal** and ... **demodulating the reflected amplitude modulated signal...**” as set forth in independent claims 21 and 32.

As a threshold matter, Rudd, the primary reference, is wholly devoid of any teaching, suggestion, or motivation for amplitude modulating a signal prior to transmission of the signal to an object of interest. Rather, Rudd merely discloses diffracting a laser beam and shifting the frequency of a portion of the laser beam using an acousto-optic device such as a Bragg cell (*see*, e.g., col. 2, lines 51-55 (“Upon entering the Bragg cell 16 light beam A is partially deflected by the stress pattern which acts as a diffraction grating, as shown in FIG. 2. The deflected beam B is also shifted in frequency by an amount equal to the frequency of the sonic wave”)). Clearly, Rudd is unconcerned with *amplitude modulating* a signal prior to transmission to an object to be tested. Further, Rudd fails to teach or suggest receiving a reflected amplitude modulated signal from a vibrating object, and demodulating the amplitude modulated signal to extract vibration information. As such, Rudd fails to disclose each element of Applicants’ claimed invention.

Russell, et al. fails to cure the deficiencies of Rudd. First, Russell, et al. relates to a field of endeavor (optical switching) that is entirely different from the present invention. As such, Russell, et al. is non-analogous art. Second, even though Russell, et al. discloses (and the Office Action suggests) that Bragg cells are capable of amplitude modulating signals, both Russell, et al. and the assertions in the Office Action fail to provide any teaching, suggestion, or motivation to employ an amplitude modulation scheme in a vibrometer. Indeed, the mere fact that a Bragg cell may be capable of amplitude modulating a signal does not, by itself, teach or suggest the use of amplitude modulation in a vibrometer. Third, even if one were to combine the teachings of Russell, et al. with Rudd, one would still not arrive at Applicants’ claimed invention. Rather, the resulting combination would be an optical vibrometer that utilizes a Bragg cell to diffract a laser

beam and shift a portion of the diffracted light in frequency, but does not amplitude modulate the signal prior to transmission of the signal or demodulate a reflected amplitude modulated signal. Therefore, neither Rudd nor Russell, et al., taken alone or in combination, teach or suggest each element of Applicants' claimed invention as set forth in independent claims 1, 11, 21, and 32 and claims 2, 7, 9-10, 12, 17, 19-20, 22, 27, 29-31, 33, 38, and 41-43 depending therefrom.

Applicants submit that claims 3-6, 13-16, 24-26, and 35-37, which depend from independent claims 1, 11, 21, and 32 and contain all of the limitations thereof, are patentable over Rudd in view of Kljuev, et al. As stated earlier, Rudd fails to teach or suggest modulating an electromagnetic signal with a modulating signal to provide an amplitude modulated signal prior to transmitting the signal to an object of interest, receiving a reflected amplitude modulated signal from the object, and demodulating the reflected amplitude modulated signal to extract vibration information, as set forth in each independent claim of Applicants' claimed invention. Kljuev, et al. fails to cure the deficiencies of Rudd, and is also absent any teaching, suggestion, or motivation to amplitude modulate a signal prior to transmission of an object, receiving reflected amplitude modulated signals from the object, and demodulating the amplitude modulated signals to extract vibration information. Indeed, Kljuev, et al. merely discloses a device for measuring vibrations that comprises a microwave generator that transmits microwaves through a parabolic antenna to an object. Absolutely no mention is made of amplitude modulating a signal prior to transmission of the signal to an object, nor is any mention made of receiving a reflected amplitude modulated signal from an object and demodulating the reflected amplitude modulated signal. As such, Applicants submit that claims 3-6, 13-16, 24-26, and 35-37 are patentable over Rudd in view of Kljuev, et al.

Applicants submit that claims 8, 18, 28, and 29, which depend from independent claims 1, 11, 21, and 32 and contain all of the limitations thereof, are patentable over Rudd in view of Flock, et al. Rudd, discussed earlier, fails to teach or suggest modulating a signal to provide an amplitude modulated signal prior to transmission of the signal to an object and receiving and demodulating reflected amplitude modulated signals. Flock, et al. is also absent such teaching, suggestion, or motivation, and fails to cure the deficiencies of Rudd. Flock, et al. discloses a vibrometer that uses a laser diode to send a signal to an anatomical structure using coupling optics, and measures a speckle interference pattern reflected anatomical structure. As such, Flock, et al. is wholly devoid of an teaching, suggestion, or motivation to amplitude modulate a signal prior to transmitting the signal to an object of interest and receive and demodulate reflected amplitude modulated signals. Therefore, neither Rudd nor Flock, et al., taken alone or in combination, teach or suggest each element of Applicants' claimed invention as set forth in claims 8, 18, 28, and 29.

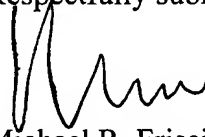
Finally, Applicant submit that claim 40, which depends from independent claim 32 and contains all of the limitations thereof, is patentable over Rudd in view of Wang, et al. Neither Rudd nor Wang, et al. teach or suggest amplitude modulating a signal prior to transmission of the signal to an object, and receiving and demodulating reflected amplitude modulated signals. As such, Applicant submits that claim 40 is patentable over Rudd in view of Wang, et al.

All issues raised in the Office Action are believed to be addressed. Claims 1, 6, 10, 11, 16, 20, 21, 26, 27, 31, 32, 37, 38, 40, and 43 were amended. Claims 1-22, 24-33, and 35-47 are

pending in this application, and are believed to be in condition for allowance. No new matter is believed to have been added. Reexamination is requested and favorable action solicited.

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Respectfully submitted,



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